SCIENCE.

FRIDAY, MARCH 20, 1885.

COMMENT AND CRITICISM.

A THOROUGH and systematic scrutiny of the heavens for stars of large parallax, or stars comparatively near our solar system, has long been regarded a desideratum in astronomy. The bearings of such research on the laws of distribution of the stars throughout the universe of space are such that no substantial progress in the discovery of these laws can be made until the parallaxes, or what is the same thing the distances, of a large number of suitably chosen stars have become known. The determination of the parallax of a star necessitates the exercise of the utmost skill of the observer, and taxes to no small degree the judgment of the computer in reducing the observations; and only a few astronomers have been known to undertake the task. The parallaxes of two or three stars only have been determined by American astronomers, among whom Professor Hall of Washington is foremost, if not alone. He has also called attention in the *Analyst* to the facility with which the work may be conducted by a careful observer, and has developed the necessary formulas of reduction in such attractive shape that it is rather remarkable that so few of our observatories have engaged in the work. We commend it to good observers looking about for the opportunity of employing a moderate instrumental outfit to the best advantage.

When, however, we come to the determination of parallaxes in bulk, astronomers everywhere seem to have shrunk from the undertaking, each waiting for another to lead, until Dr. Ball, astronomer royal of Ireland, made a serious beginning of the task, about eight years ago, at the observatory of Trinity college, Dublin. While others have been content to measure and reduce the parallax of a single star occasionally, Dr. Ball is encouraged by the contemplation of a working-list of some nine hundred stars, and he has already completed and published his work upon nearly one-half of this number, — an unparalleled labor in this branch of astronomy.

We should mention here, also, the determinations of stellar distances made in the southern hemisphere by Dr. Gill and Dr. Elkin, the results of which indicate extraordinary precision of measurement. With renewed enthusiasm in this research, these astronomers have outlined a plan of operations which contemplates an extended parallactic survey of the stellar heavens, and which may be expected to be brought to a conclusion in eight or ten years. Dr. Elkin is already engaged in the preliminaries of the work with the fine heliometer belonging to the observatory of Yale college; and Dr. Gill has only lately placed with the Messrs. Repsold of Hamburg the contract for a new heliometer of seven inches aperture, — the largest ever constructed. In about two years from the present time he will begin at Capetown his part of the work of carrying out this conjoined programme of parallax research.

MANY HAVE remarked the gradual assimilation of scientific discoveries by the οἱ πολλοι. To us the process seems comparable to the percolation practised by the pharmacist. He takes good alcohol, and pours it on the drug of which he desires to extract the active principle. The spirit gradually soaks down through the substance, extracting its soluble portions, and issues from the lower end of the percolator, much changed in character. Usually, in the case of the druggist, the result is satisfactory; but, when scientific facts — the pure alcohol of science — are concerned, the additions received by percolation are almost invariably of such a nature that the percolate is useless. This is

strikingly exemplified in the case of a recent pamphlet containing 'a few facts about carpets;' but the result is the more interesting, since in this one example the analogies of the various stages of percolation are clearly seen. The writer starts with his pure *spiritus vini Gallici*, good in itself, but capable of being considerably changed by the maceration of improper substances. This alcohol is the fact, capable of scientific demonstration, that moths destroy carpets. Thus he runs on: "MOTHS. — Many are not aware that all the present damage is done when the millers commence to fly, as their very presence indicates the absence of the worm. It is to prevent the miller's incubating, that precautions should be taken." The alcohol with the next step begins to be discolored in the following manner, though to a slight extent: "A large proportion of the millers never hatch eggs, but die without causing any harm." We will let it soak awhile, and then this result is found: "The male miller, which does not fly, but runs very rapidly, is easily detected by his triangular-shaped figure; but, keeping himself out of sight, he is not so easily found."

Dropping our simile for the moment, we wish to call attention to a peculiar and reprehensible bit of wickedness of the 'males' in hiding from their lawful 'better halves;' for, so our author says, "his hiding explains the devious flights of the female in his search." Give ear now, good housewife, and recollect, that, besides protecting your carpets, you are avenging a great slight upon your sex — a slight which brings about a perpetual leap-year — by following out to its fullest extent the suggestion embraced in the following sentence, which, to return to our simile, renders our percolate still darker: "The killing of one male is equal to the extinction of many ordinary millers." Our alcohol is now almost saturated. Let us draw the stopper from the percolator, and allow the fluid to run out. It appears as follows: "The male miller is commonly known by the name of 'silver-fish.'" The process is complete; we have obtained our percolate; by degeneration our moth has evolved a thysanure. Our alcohol is spoiled: what shall we do with it?

A NEWSPAPER RUMOR from Washington, printed in the Boston *Advertiser* last Monday, to the effect, that, in consequence of a charge of extravagance in the conduct of the U. S. geological survey, Professor Shaler of Cambridge was 'talked of to succeed Major Powell,' brought out an immediate rejoinder from the former on the following day, defending the survey from a charge so injurious and so untrue. "It is my firm belief," says Mr. Shaler, "that no one of the scientific departments of the government has been so well and economically managed as the geological survey since it came under the able direction of Major Powell." The same conclusion will be reached by any one who gives the subject any proper attention, or who is acquainted with the character and methods of the able chief of this survey. A change made on such a charge, without honest and open investigation, would be iniquitous: after such investigation, there could be no doubt of the result.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Solar eclipse of March 16.

THE solar eclipse was very successfully observed here to-day, under good atmospheric conditions. Cumulus clouds were scattered here and there about the sky, but fortunately they did not obscure the sun at any critical moment.

The photographic apparatus was in perfect working-order, and about fifty pictures of the eclipse were secured, with the assistance of Mr. J. L. Lovell. All of these developed well; and the exposures were so distributed with reference to the times of the two contacts, and to the occultation of solar spots, that they may be expected to give good results for the relative positions of the centres of the sun and moon.

The last contact was also observed optically by Professor Esty, Mr. B. Rush Rhees, Mr. Thomas C. Esty, and myself, the results all agreeing within seven seconds. DAVID P. TODD.

Lawrence observatory, Amherst, Mass., March 16.

Hereditary abnormality of sense-organs.

Dr. Mason's note on 'Hereditary malformation' (*Science*, v. 1885, 189) reminds me of a case in which inherited abnormality of sensitiveness in sense-organs is of opposite signs.

The father (D. A. of Independence, Io.) has unusually acute hearing. The degree of acuteness cannot well be expressed in terms of normal audition: but it will suffice to say that he distinguishes voices, whispers, and other sounds at considerably beyond the ordinary range; that he frequently hears sounds inaudible to his companions; and that he perceives, discriminates, and comprehends faint sounds with great facility. His wife's audition was normal, and that of the progeny is variable. Expressing normal audition by N, and arbitrarily evaluating acuteness above and below this standard, the status of the family, including consorts (indicated by italics), is about as follows: —

FIRST GENERATION.	SECOND GENERATION.	THIRD GENERATION.
D. A. 65—N+2		
Mrs. L. S. A.		
(deceased) —N	*G. W.* 45—N	
	Mrs. M. A. W. 42—N	(5 children, all —N)
	J. A. 40—N+1	
	Mrs. M. D. A. 38—N	(7 children, all —N)
	G. M. 42—N—1	
	Mrs. J. A. M.	
	37—N—3	Miss E. M. 11—N+1
		J. M. 9—N
		Miss B. M. 7—N
	Miss M. A. 32—N+3	
	D. H. A. 30—N—3	
	T. A. 28—N—3	

The partially deaf members do not perceive the ordinary voice, but follow conversation readily if the voice be raised as high, say, as that of an out-door speaker.

It is noteworthy that none of the family were born deaf, but that sensitiveness of the auditory apparatus diminished during youth, either progressively or by stages coinciding with slight catarrhal attacks or other physiologic disturbances. The grandchildren born thus, scarcely reached the age at which deafness began to appear in the second generation.

W. J. MCGEE.

Washington, D.C., March 11.

Preservation of jelly-fishes at the Naples zoölogical stations.

Zoölogists are to be congratulated upon the success which has at last attended the efforts of Signore Lo Bianco, the skilful conservator of the zoölogical station in Naples, towards the preservation of Siphonophorae. So extremely delicate are these complicated organisms as to have rendered futile all efforts hitherto made for their preservation; and students have been compelled to have recourse to drawings or models for the study of their structure in the absence of living specimens. The least carelessness on the part of the collector, results, as a rule, in the loss of many of the slightly attached parts; and if, perchance, the animals are brought in safety to the laboratory, they are available for study only during a very brief period. For over eight years Signore Lo Bianco has carried on experiments, attended with the greatest patience and skill and no small pecuniary outlay, only to meet with the fate which has ever attended attempts at their preservation, — to see them fall into a hundred pieces. Every working zoölogist can therefore readily imagine the satisfaction following the discovery of a method through which every museum may now place upon its shelves specimens of Mediterranean Siphonophorae retaining all the beauty and transparency of living specimens, — a privilege of which the directors of the various European museums are by no means slow in availing themselves, a large number of orders having already been received at the station for complete sets. Henceforth students of inland laboratories can study these interesting animals as satisfactorily as those at seaside laboratories, specimens being furnished, if desired, prepared especially for histological purposes. At no other place in the world has the art of preserving marine animals attained such perfection as in the Naples station, and at no other place is it possible. Owing to the large corps of skilled collectors, and to the rich fauna of the Gulf of Naples, material is constantly on hand for experimentation, and is manipulated by experts, who are instructed to spare no time or expense in the search for methods which shall retain the animals in their natural expanded conditions, and, if possible, with the brilliant colors of living specimens. A most interesting example is that of Corallium rubrum; the precious coral in which all the minute polyps are seen, with their tentacles fully expanded, furnishing a much more instructive object than the bits of dried twigs ordinarily to be seen in collections. Of the Siphonophorae, the most difficult of preservation were Forskalia contorta, Apolemia uvaria, Agalma Sarsii, Halistemma rubrum, Physophora hydrostatica, and Praya diphyes. These, besides many others, may now be obtained at prices which barely cover the cost of preparation, varying according to size, rarity, and process required, from one to thirty francs. The last two forms, owing to their habits, are not always on hand, appearing one day in hundreds, months elapsing before the collector again meets with them. American institutions have thus far been much behind those of Great Britain and the continent in taking advantage of the unparalleled facilities afforded by the Naples zoölogical station; Williams college and the University of Pennsylvania being the only ones which have taken tables and sent representatives, the latter being the only one represented at present. Several Americans have been able to occupy tables for short periods through the courtesy of German universities; but it would be much more creditable to America were her zoölogists able to meet with similar encouragement from home institutions.

C. S. DOLLEY.

Naples, Feb. 28.

Economy of fuel.

In your No. 103 of Jan. 23, 1885, under the heading 'Economy of fuel,' the coal-consumption of the steamship Oregon is stated at 16 tons per mile, which is equivalent to 48,000 tons for the Atlantic voyage! [Corrected, vol. v. p. 122.] I beg to request that you will publish, in correction of the above, the accompanying table, compiled from data furnished me through the courtesy of Mr. A. M. Underhill of the Guion line.

Name of steamer.	Tonnage.	Horse-power.	No. of boilers.	No. of furnaces.	Average speed of best trip from Sandy Hook to Queenstown, Ireland.	Fuel consumed per 24 hours, at $4\frac{1}{2}$ tons per furnace.
					Knots.	Tons.
Arizona .	5,147	6,000	6	36	16.21	162
Alaska . .	6,932	11,000	9	54	17.44	243
Oregon . .	7,374	13,000	9	72	18.56	324

BAILEY WILLIS.

THE JOINT COMMISSION AND THE SIGNAL-SERVICE.

ONE of the last acts of the late congress was to continue in power the joint commission appointed "to consider the present organization of the signal-service, geological survey, coast and geodetic survey, and the hydrographic office of the navy department, with a view to secure greater efficiency and economy of the administration of the public service in said bureaus."

Thus far this commission seems to have elicited from the witnesses who have testified before it a considerable diversity of opinions, although each one is positive that his own service is properly conducted and needs no change. Major Powell and the committee of the National academy of sciences undoubtedly take a broad view of the questions at issue, and defend the abstract and theoretical importance of a union of all scientific work under one head, which may be either a person or a commission. The others generally defend special questions; such as, Is each organization efficient or economical? Does each co-operate with other departments? Is there an immediate need for any change?

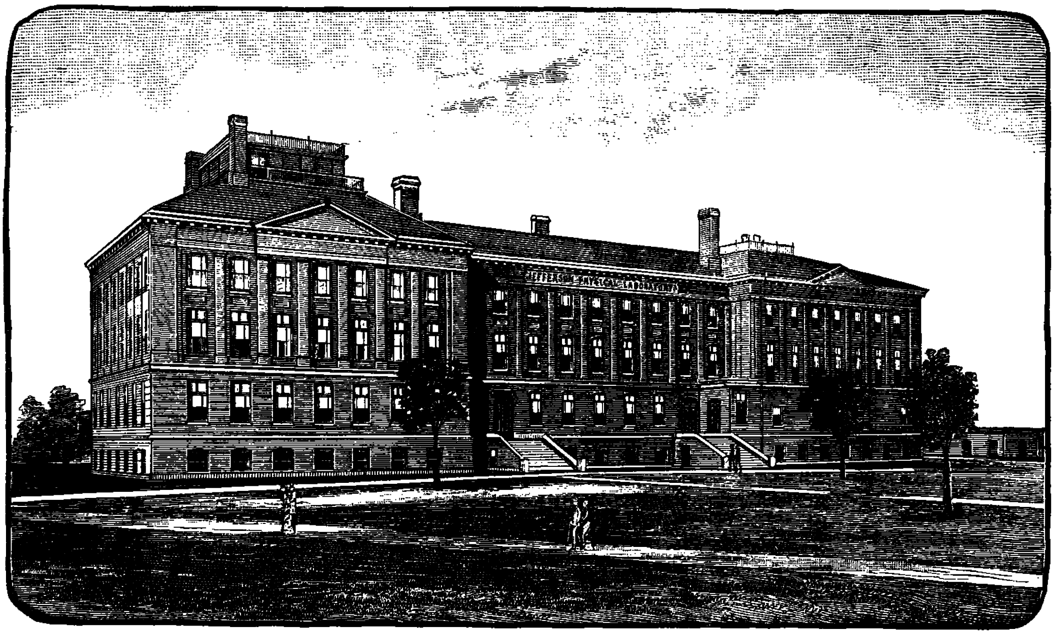
Many of the questions and replies imply that there are some underlying fundamental questions that should be discussed and settled before considering the matter of efficiency and economy. Some of these may be suggested, as follows: Shall pure science be separated from applied science? Shall the refined operations of the coast-survey, signal-office, etc., be classed as science, or as economic arts? Shall the civilian scientific element in the country be intrusted with applied sciences, or shall it only be employed to teach these to military and naval officers? Shall such officers be taken away from their proper work, thereby spoiling the little nucleus of an army and navy that the government maintains in times of peace? Shall the ten or twenty millions spent annually by government in internal improvement be disbursed by officers skilled in military engineering, or by civilian engineers especially fitted for the task? Shall all executive work be in the hands of various bureaus, including one of public works, while all scientific questions are referred to a special bureau of science whose members devote their whole time to the government service? Will education, science, and knowledge, and the progress of the people throughout the land, be stimulated more by giving scientific work to army officers, or by giving it mostly to civilians? Shall West Point, Annapolis, Willets Point, Fortress Monroe, Fort Myer, Fort Leavenworth, become not merely military, but also scientific, schools, with the understanding that the graduates of the civilian scientific schools at Cambridge, Ithaca, New York, New Haven, and elsewhere, cannot hope to receive much encouragement in the way of government employment? Shall our government make a decided effort to stimulate the general spread of education and scientific investigation by throwing its patronage into the hands of competitors from every rank of life? Shall not army, navy, and civilians at least stand on an equal footing in times of peace, and in questions of fitness to conduct works of applied science or higher engineering?

A slight examination will certainly show that very many of the public works carried on by the executive branch of our federal government have been assigned, whether by the president or by congress, in a very unsystematic manner, to the various departments and bureaus at Washington. Sometimes this has occurred, to the detriment of the work; but generally it has been to suit the exigencies of some temporary condition of affairs, and frequently for some political or personal reason. There is need, in fact, of considering the question of re-organization of all the government work.

However, the special and present business of the joint commission is to suggest, if possible, how to infuse a little harmony, efficiency, and economy into some or all of the public work; and most of the witnesses have confined their remarks to this restricted temporary aspect of affairs, leaving it to the commission, by cross-questioning, if possible, to draw more

profound truths from the partisan testimony of each witness.

The most expensive and important of the organizations studied by the commission is the signal-service; and considerable interest attached to the testimony of Professor Abbe, himself a member of the National academy of sciences, as it was hoped he would contribute facts favoring its transfer to a civilian scientific bureau. It is difficult to believe that he does not appreciate the strong arguments on this side of the question; but, like most government employees, he has chosen to consider the commission as an aggressive body, inquisitive as to whether the laws of congress have been properly carried out by his branch of the executive: he has therefore not touched upon questions of the general policy of the federal government, but has simply defended the present administration of the signal-office as being quite efficient and economical, and is especially strong in his defence of Gen. Hazen. He thus leaves it to his examiners to penetrate to the core of the matter, and to show that the proper interpretation of all and even of his own testimony affords an unanswerable argument against a purely military administration, and rather in favor of a purely civilian business and scientific one. The committee has evidently failed to obtain an exposition of the arguments for and against the present management of such institutions as the naval observatory, the signal-office, nautical almanac, geodetic survey, etc.

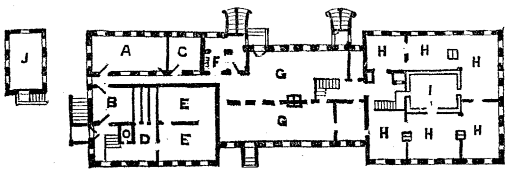


THE NEW PHYSICAL LABORATORY AT HARVARD COLLEGE.

THE JEFFERSON PHYSICAL LABORATORY.

THE Jefferson physical laboratory, which has recently been completed at Harvard university, is a three-story brick building with a basement, the floor of which is nearly on a level with the surface of the ground. The building is 209.4 feet long. The two wings are 67 feet square, and are connected by the main walls of the building, which are 46.8 feet apart. The ground-plan thus consists of two squares connected by a rectangle. The longest line of the laboratory runs very nearly east and west: there is therefore a great southern exposure, with no

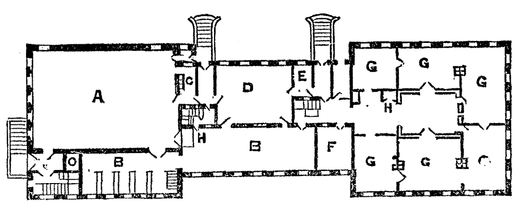
trees or buildings near the laboratory to interfere with the employment of sunlight for optical purposes from dawn to twilight. The western wing contains no iron, all the gas-pipes and steam-pipes being made of brass. This wing has a separate entrance, and can be iso-



BASEMENT.

A, workshop; B, forge; C, battery-room; D, fire-room; E, coal; F, mercury-room; G, receiving-rooms; H, special investigation rooms; I, constant-temperature room; J, engine-room.

lated from the eastern wing, which contains the large lecture-room and the elementary laboratory. The vibrations resulting from the movement of classes are thus obviated in the western portion. Each room in the basement and first floor of the western end is provided with brick piers, which are so arranged that instruments placed upon the south-west or the north-west corner piers can command long lines of sight east and west, and north and south. In the centre of the western wing, below the floor of the basement, is a constant-temperature room. This room is at the base of a tower, the walls of which are at least a foot from the main walls of the building. This tower rises to the roof, from which, however, it is entirely separate. In this way the effect of the wind is prevented from communicating vibrations to this inner tower. In the tower are placed large shelves of slate, which serve as piers

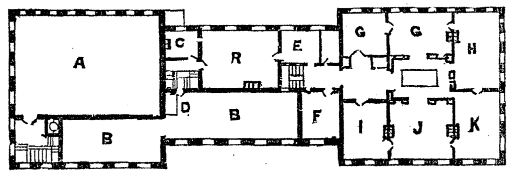


FIRST FLOOR.

A, space under lecture-room; B, first-story cabinets; C, preparation-room; D, recitation-room; E, professor's room; F, balance-room; G, special investigation rooms; H, elevators.

on the second and third floors. The arrangement of rooms in the western wing is such that any room can be entered from the main hall without going through any other room. Moreover, two or more rooms can be thrown together if any experiment demands such an arrangement. There is gas and water in each room. Provision is also made for a line of sight entirely within the building nearly two hundred feet long.

The portion between the two wings is devoted to recitation-rooms and cabinets. A lecture-room capable of seating an audience of three hundred is placed on the first floor of

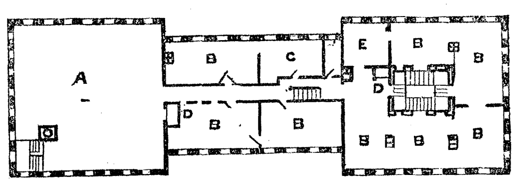


SECOND FLOOR.

A, lecture-room; B, second-story cabinets; C, professor's room; D, elevator; E, professor's room; F, library; G, optical rooms; H, Rumford lecture-room; I, sound; J, special investigation room; K, chemical laboratory; R, recitation-room.

the eastern wing. Immediately over it is the large elementary laboratory sixty by sixty feet. Connected with the latter are several rooms for special investigations, which do not require the great steadiness of the western end. Immediately beneath the lecture-room is the workshop, together with a battery and a mercury-room. Power is conveyed to the workshop through a large tunnel which connects with an outside engine-house, in which is placed a twenty-five horse power engine and a seven horse power gas-engine, together with two dynamo-electric engines.

The ground upon which the laboratory is placed consists of gravel, with a substratum of clay, which, however, is below the lowest foundation of the laboratory. The nearest street is more than three hundred feet distant, and it is found that no prejudicial vibrations are com-



THIRD FLOOR.

A, elementary laboratory; B, special investigation rooms; C, library; D, elevators; E, photographic chamber.

municated to the piers. A vessel of mercury placed upon them, however, shows slight crispations and vibrations. The shelves placed in the isolated tower are steadier than the piers. This is probably due to the effect of the outside walls of the building in cutting off the surface vibrations, and suggests, that, if the future builders of physical laboratories desire ideal steadiness, they should sink walls outside

the building, and build large masses of stone or brick upon which piers for delicate instruments could be placed. The conditions for steadiness, however, in the Jefferson physical laboratory, are fulfilled sufficiently for practical purposes.

The laboratory, together with its heating and lighting arrangements and engines, cost a hundred and fifteen thousand dollars. This sum was given by Mr. Thomas Jefferson Coolidge, on condition that seventy-five thousand dollars more should be raised for maintaining the laboratory. Many friends of the university contributed to this income fund.

The laboratory is named in honor of Thomas Jefferson, the ancestor of Mr. Coolidge. Jefferson, while president of the United States, evinced great interest in the promotion of university education in America,—an interest which took a practical form in the foundation of the University of Virginia; and the seed thus sown, it will be seen, bears fruit even unto this day. JOHN TROWBRIDGE.

EVIDENCES OF BEACHES IN THE CINCINNATI GROUP.

THE presence of old beaches above present water-level is readily perceived on many modern lake and ocean margins, notably around Great Salt Lake and on the Peruvian and Chilian coasts of South America. The evidence of similar beaches in geological groups cannot be considered so decisive, nor is it so conspicuous.

That most of the strata of the Cincinnati group were deposited in deep water is probable. They contain many fossils whose modern relatives live in deep seas, and it is not likely that it was different with the ancient forms. Brachiopods, crustaceans, bryozoans, polyps, are all inhabitants of comparatively deep water, at least; and these forms are found in extraordinary abundance in the Cincinnati group.

Two apparently well-defined shore-lines have been noticed in the rocks in the vicinity of Cincinnati. One of these was first referred to by Dr. Locke some forty years ago. It crops out about three hundred feet above low-water mark, and is characterized by the dumb-bell fossil known as Arthraria. It is apparently to this horizon that Miller refers in the *Cincinnati quarterly journal of science*, i. 64, where he speaks of wave-lines in the rocks. He says,—

"These wave-like rocks are composed in a very large part of fragments of crinoids, principally of the Heterocrinus simplex, and appear to have been formed by the action of the waves in first breaking to pieces the animal skeletons, and then leaving them in ridges, as if to mark for all future time the course of the waves. These rocks are found in all the hills about Cincinnati, and as far east as Plainville [nine miles]. A number of fossils are found below these rocks that have thus far not been found above them; and, on the other hand, many have been found above that have not been found below. . . . The fossils which are common to both elevations comprise more than half of all those found below these rocks. And yet, on further examination, it may appear that the causes which led to the formation of these waves in the rocks, also caused a considerable change in the animals which inhabited the ocean at that time."

Here the probable existence of a shore-line is indicated. It seems to mark one of those periods of elevation which occurred during the deposition of the strata. The fact that many fossils are found above which are not common below, would indicate a serious disturbance of conditions,—a change which caused the extinction of many previously common species, and allowed the introduction of a few entirely new ones.

It is at about this horizon that rocks bearing marks of surface water-washings, and evident traces of the action of trickling water, are found. There are also indications in the rocks of the rippling of water, such as could occur only along the margin of a shallow sea. These marks have been described as Algae under various names, but their true character has been shown by comparing them with modern marks of a known origin.

A second ancient shore-line, as it appears to be, crops out at various points in the vicinity of Cincinnati. Probably the best exposure is at Ludlow, Ky., along the Ohio River, opposite the city. Professor Orton, in speaking of the waved structure of the rocks, refers to this locality as follows:[1]—

"The rocks exhibiting this structure at the point named [river-quarries] are the most compact beds of the fossiliferous limestone. The bottom of the waved layer is generally even, and beneath it is al-

ways found an even bed of shale. The upper surface is diversified, as its name suggests, with ridges and furrows. The interval between the ridges varies, but in many instances it is about four feet. The greatest thickness of the ridge is six or seven inches, while the stone is reduced to one or two inches at the bottom of the furrow, and sometimes it entirely disappears" (see figure).

[1] Geology of Ohio, vol. i. p. 377.

One of the explanations offered for this wave-structure is "that the floor of the Cincinnati sea was acted on from time to time by waves, or similar movements of the ocean-waters;" but it seems just as probable that these ridges were made by the action of waves on the shore. The stratum is made up of fragments of crinoid stems, brachiopods, and other forms of life. It is just as if it had been exposed to the action of the weather and the waves for such a long period of time that a fine sand was formed of crinoidal and shelly fragments. It is well known that the continual dashing of waves on a shore will soon reduce a mass of shells to powder. Dr. Leidy mentions [1] that while at Atlantic City, the beach, after every storm, is strewn with immense numbers of shells: in a short time these become reduced to fragments, and eventually disappear.

Every one who has collected shells on sea-beaches is aware of the difficulty of procuring perfect specimens after they have been exposed to atmospheric agencies for a short time. Still in some places, notably in the Bay of Fundy, tracks left on the mud, raindrop impressions, traces of leaves, and other marks, are preserved in a perfect state. At the same time it seems unlikely that organic matters will be preserved from decay. For this to be effected, it is necessary that they be covered almost immediately, and so deep that they are protected from the air or atmospheric changes. Both these conditions — the one necessary for the preservation of tracks on mud, and the other to entomb perfect organisms — seldom seem to occur at the same time and in the same place: consequently it rarely happens that in the stratum where surface-marks, burrows, and trails occur, *perfect* fossils of any sort are found. While the whole surface of immense slabs of rock may be covered with trails, burrows, or impressions of organisms, *no complete fossils are preserved*. In the stratum above or below they may and do occur. But, while no perfect specimens are found, fragments innumerable remain. Small pieces of crinoid stems, fragments of trilobites and brachiopods, jumbled together in inextricable confusion, are the only signs of fossil organisms. Sometimes they lie in heaps, as if thrown together by a swirl in the tide; sometimes there is only a fragment here and there, and even it shows unmistakable signs of the action of the weather.

Mud-cracks, too, evidence the fact that the surface was exposed to the action of the sun long enough to dry and crack the deposit. These cracks, filled up by a subsequent deposit of mud, remain to tell of their origin. These fossil mud-cracks are found in the same locality as the burrows, trails, and other surface-markings.

[1] Proc. Philad. acad., 1884, p. 12.

Professor Newberry, in the 'Geology of Ohio,' [1] says that the fact that the Cincinnati arch was upheaved before the deposition of the upper Silurian rocks is shown by the strata of the upper Silurian terminating in a feather-edge on each side of the arch, and by the Devonian being so reduced as to render it doubtful if it ever covered the top of the rocks of the Cincinnati group. Therefore it is probable that the Cincinnati arch, "during the upper Silurian, and through most if not all of the Devonian ages, . . . formed an island raised above the surface of the sea."

If this was so, a shore-line would mark the conjunction of the lower Silurian and the Clinton; and along this shore-line would be the place to expect to find such markings as would be made on an ocean-beach. In this regard, Professor Newberry says,[2] —

> "In Adams county the interesting discovery was made by Professor Orton, that a part of the Clinton is formed of a conglomerate of well-rounded limestone pebbles and worn fossils of the blue limestone [Cincinnati group] series."

And lately Mr. U. P. James has found a slab of rock near the top of the rocks of the Cincinnati group which shows well-marked and unmistakable impressions of raindrops, — marks which could not, by any possibility, have been made and preserved, except on an exposed surface.

It is well known that the Clinton group of New York is the one where most of the trails, burrows, and beach-markings have been found. Professor Hall says in regard to them,[3] that

> "They occur in greater or less number and perfection throughout the entire extent of the group;" and that (*Ibid.*, p. 26) "from the character of the surfaces of the arenaceous beds in which they occur, I am inclined to the belief that many of them were made while the bed was exposed above water, and most of the others in very shallow water. In many instances the marks of what appear to be *wave-lines* are still preserved upon the surface of the layers. These markings have been regarded as a line of beach at the period of the Medina sandstone; and the strata under consideration follow in immediate succession to that period. They are, moreover, associated with pebbly beds which were probably littoral."

Thus, if the markings and the fossil remains found in the Clinton are to be regarded as made on exposed surfaces, and if these same markings, or similar ones, are found in the rocks of

[1] Vol. i. pp. 94 *et seq.* [2] *Ibid.*, p. 103.
[3] Paleontology of New York, vol. ii. p. 27.

the Cincinnati group, the inference is just, that the markings from the latter had their origin under the same conditions. There is no reason for supposing that the Cincinnati Island was not subject to elevations and depressions alternately. The evidence here given, showing the presence of three former shore-lines, seems conclusive. Probably, were other localities and other groups examined in a similar manner, similar facts would be found.

JOSEPH F. JAMES.

HUDSON-BAY ESKIMO.

IN the report of the Hudson-Bay exploring expedition, it is stated that the only inhabitants of Hudson Strait and the northern part of the bay are the Eskimo, who have become quite familiar with the ways of civilization. The families are small, mothers having rarely more than two or three children, which, in consequence of the absence of farinaceous food, are suckled till three or four years of age. The number of Eskimo appears to be diminishing, as there are abundant traces of their former presence in force. About six miles south of Port Burwell are the remains of a large settlement, with subterranean dwellings, in a fair state of preservation, where remains of stone pots and implements are mixed with those of more modern date. At Port De Boucherville distinct remains of a very ancient Eskimo camp, in the form of heaps and circles of stones, are found on a raised beach at the head of what had been a cove when the sea-level was about thirty feet higher than at present. At another place in the same vicinity are more modern remains, consisting of rings of tent-stones, several rectangular walls a few feet high, and *caches* of a beehive form about six feet in height, such as are now used for storing meat, or as hiding-places from which to kill game. Around Port Laperrière, also, camping-places are found, which, from their elevation above the sea-beach, the decayed nature of the larger bones lying about, and the manner in which the circles of stones are embedded in moss and overgrown with lichens, must be from one hundred to three hundred years old. Still more ancient Eskimo works are discovered in the valley which comes down to the head of the harbor. These consist of a row of stones running athwart the brook at a contracted part of the valley, which would be suitable for the Eskimo method of trout-fishing if the sea were eighty feet higher than it is at present.

Along the Labrador coast the Eskimo gather in small settlements round the Moravian mission-stations; Nain, with a population of about two hundred, being the largest. Here they are educated, and the missions are self-supporting; the missionaries supplying the Eskimo, purchasing their catch and shipping it to London, and communicating with Newfoundland during the summer by a mail-steamer which makes occasional trips as far as Nain. Lieut. Gordon gives the Eskimo the highest character for honesty and docility.

PHYSICS IN THE SCHOOLS.

PROFESSOR WEAD has published the replies to a circular distributed by the commissioner of education, Mr. John Eaton, in regard to the best method of teaching physics in the secondary schools. The general impression obtained from these replies, which are from high-school teachers as well as from college professors, is that a certain amount of laboratory work in physics is desirable. Very few, however, of the teachers who have replied, can apparently speak from actual experience of the advantages of the laboratory method. Within a quarter of a century there has been a marked change in the views of those who have entered upon chairs of physics in our various colleges. The earlier professors of so-called natural philosophy looked at their subject from a semi-literary point of view, and did not descend into the laborious arena of the laboratory, where their half-brothers the chemists had long preceded them. To-day there are physicists who laugh at the old method of teaching physics; and, although we are somewhat conservative, we also are tempted to indulge in a sly laugh in our sleeve.

The problem of the best method of teaching physics in the secondary schools, however, can only be a faint reflection of the methods adopted in the universities. We are inclined to believe that it should aim to be a faint reflection, — popular lectures for stimulating the imagination of the boy, and rough experiments for the masses, in order to train the scientific instinct and the powers of observation.

The report contains valuable information in regard to the teaching of physics in England, Germany, and France. The general impression gained from this report is that the new methods of teaching physics have not been adopted in a large enough number of cases to warrant any conclusions from a study of those cases. The training of teachers is steadily improving, and every year our colleges and universities send out men imbued with modern methods of laboratory instruction. These men must have a marked influence on the future methods of teaching physics.

HALLUCINATIONS.

WHEN a patient is hypnotized, he imagines that he sees all things as they are suggested to him, provided he is a healthy subject. But in these hallucinations a person who has lost the chromatic sensibility cannot be made to see suggested colors to which he is naturally blind. If the achromatopsy be limited to one side, the left for instance, and the hypnotized subject has the right eye closed, he obstinately affirms that he does not see the suggested color, and cannot be made to see it until the right eye is opened.

There is a second thing which shows, better than the preceding, that hallucination and sensation have the same cerebral origin: it is the property which hallucinatory images have of provoking the same

Abstract of an article by BINET and FÉRÉ in the *Revue scientifique*.

effects of contrast as of sensation. Take a card, white on one side, and half green and half white on the other, with a dot in the centre of each side, to hold the attention. Look steadily at the green-and-white side for a minute, then turn the card, and the half corresponding to the green will have a red tint, and the other half will have a complementary green tint. The consecutive red image has developed, by induction, the green sensation in a part of the eye which had been impressed only by white. The same results are obtained if the subject be hypnotized. The experiment will fail if the subject is blind to the suggested color. If a subject is blind to a certain color, a peculiar case results. On giving him the hallucination of green, the sensation of red cannot be induced; but in giving the hallucination of red, which he can see, the induced sensation of green (to which he is blind) is produced.

The production of consecutive images is a normal phenomenon: so, in all hallucinations which last a certain time, a consecutive image follows. If one causes a patient in a hypnotized state to look at a square of white paper with a point in the centre, suggests that the square is red, and then suddenly presents a second similar square, the subject will say that the point is surrounded by a colored square, and the color will always be the complementary of the one suggested. This complementary color is the negative image left by the hallucination. It lasts only a short time, then becomes effaced. That similar phenomena are observed in the normal condition, may be proved by the following: if, with the eyes shut, we keep the image of a bright color in our mind a long time, then open them suddenly, looking upon a white surface, we will then see for a short time the image we were contemplating, but of a complementary color.

The following most curious experiment upon the mixture of imaginary colors helps to prove the same thing. Place two squares of differently colored paper at some distance upon a table; then place before the eye a plate of glass inclined in such a manner that the whole of one card can be seen directly, and at the same time a reflected image of the second. One can very readily cause the two papers to superpose, and become mixed. If we show a hypnotized patient the same thing, substituting blank cards, and suggesting colors for each card, they will appear mixed to him in the same manner. The necessary conclusion from this seems to be, that hallucination of a color is a suggested sensation, having the same cerebral seat as the real sensation.

THE OYSTER-FISHERY IN CONNECTICUT.

THE fourth annual report of the shell-fish commissioners of the state of Connecticut was recently issued, and contains, in concise form, much useful information. In its record of benefits accrued to the state by its system of ownership and moderate taxation of oyster-planting grounds, it offers great encouragement to those who would institute in each state systematic business methods in connection with this one of the most important of all our fishery interests. We have before referred to the system adopted by the commission in mapping and determining permanent bounds for the natural beds and ground available for planting. The survey of the natural beds, which are open to all oystermen under certain restrictions, has been completed. They comprise 5,805 acres. The total area of planting-grounds, designated for occupancy by the commission since its organization, is 45,046 acres, which have netted to the state $49,560. Adding to this the area previously designated by the seaside towns, and we have over 79,018 acres now under the control of individuals, of which 14,066 acres are under cultivation.

The total number of tax-paying cultivators in 1884 was 385, of whom 16 own each five acres or less, 53 between five and twenty acres each, and 332 own twenty acres or more each. The amount of tax levied, averaging ten cents per acre, was about $6,500, of which less than $50 are delinquent. This is trifling in comparison with the local taxation of grounds under town jurisdiction. Eleven hundred acres of grounds in the state of Rhode Island pay a tax or rent of a hundred dollars per acre to that state. The Connecticut commission has not valued grounds for taxation in excess of fifty dollars per acre, though lands have been reported sold during the year at from two to six times that amount. It is obvious, therefore, that the encouragement given by the state to those employed in this business is very great. The business is steadily growing. There are already over three hundred sailing-vessels and forty steamers employed, the latter with an aggregate capacity of 36,720 bushels; and several more steamers are being constructed. The first steamer was employed less than ten years ago.

There has been a very considerable increase in the sale of seed oysters and stock to neighboring states, and also in the exportation to Great Britain. Oysters for export are packed in barrels containing 950 four-year-olds, or 1,500 three-year-olds, the deep valve down and pressed very solid. One firm, exporting 10,000 barrels a year, has never lost a bushel by long passage, bad weather, or other causes. Many are shipped to California also. Accurate statistics are not available, as the oystermen seem to resent inquiries as an interference with their private business. In the course of time they will probably know their own interests better.

The chief injury sustained in the business is from star-fishes, which destroy the young oysters. It is estimated that over fifty thousand bushels of stars were destroyed last year. They are most destructive in the cooler weather. In July and August they form into great bunches or rolls for spawning, and lie quiet. In some localities there were few or none, in others such multitudes as had not been seen for many years. It has been suggested that the state should pay a small bounty for them; and, as they are worth something as a fertilizer, the sale would partly reimburse the outlay. The receipts of the commission were $13,731.84; the disbursements, $8,350.49.

SCARCITY OF LIVING ORGANISMS IN THE AIR AT HIGH ALTITUDES.

IN the Geneva *Archives des sciences* for November, 1884, Mr. Freuderich has an article upon the number of living organisms in the air of the Swiss Alps. He shows that the experiments made by Pasteur in 1860 upon the same subject, and later by Tyndall, are unsatisfactory because of the small amount of air filtered, and because it seems, from the results, that the germs were not destroyed from the *bouillon* which was used in the experiment. Other observers have found astonishing quantities of germs in high altitudes, and in all these cases it seems very probable that the liquid was not thoroughly sterilized.

In Freuderich's experiments, by means of a portable steam-pump, air was pumped at the rate of a hundred and fifty litres an hour through a small glass tube with a capillary end. This tube was stopped with a wad of spun glass to retain any floating particles. Each wad was then placed entire in the *bouillon*. Later he still further modified this method by using the tube through which the air was pumped as a culture-tube.

Mr. Freuderich's most reliable experiments were made in the summers of 1883 and 1884. On the 12th of July, 1883, at the height of 3,200 metres, in 300 litres of air, no life was found. Again, on Aug. 5, at the height of 2,100 metres, he filtered 500 litres of air, and, on the next day, 400 litres on the summit of a neighboring mountain 3,970 metres high. The filterings from these two were sown in a broth of beef, but showed no signs of life. At Schilthorn (2,972 metres), Aug. 25, 1,500 litres of air were filtered and sown, but the fluid did not cease to be limpid.

In presence of the negative results of 1883, he determined not to confine himself in 1884 to the limit of eternal snow, but to choose some places more accessible to the germs of the air. On the Aletsch glacier, July 15 and 17, at a height of 2,900 metres, he pumped 2,000 litres of air through six wads. One of the wads, after a rest of fifteen days, gave birth to an organism of the family Tortulacea, and another contained a micrococcus, which may have been accidentally introduced. The second series was carried on above snow-level in Theodule pass (3,340 metres above sea-level) on the 6th and 7th of September. But in 3,000 litres of air he could find but one bacterium. The extreme poverty of the air at these heights is sufficiently proved by these figures. While these experiments were going on, the days were clear and the wind light, both circumstances favorable to the growth of microbes.

At Niesen (2,366 metres), July 25 and 26, rain and snow fell, and rendered the work very complicated, soaking the wads, and checking the work, so that not more than 600 litres were pumped through eight wads, all of which were sown at Berne, July 27. On July 29 the liquids sown with two of them were infested with a peculiar long bacillus, never met with except in the air of Berne; the next day another was infested with the same species; a fourth gave another bacillus; and Aug. 1 a mould appeared. Finally, about the first of September, a last conserve brought forth a mould after six weeks' incubation. The two others remained sterile; and hence we have a minimum of four microbes from 600 litres. We say minimum, because it is possible that more than one germ may have been caught on those filters which produced germs. In another trial, July 31 and Aug. 1, he filtered 1,725 litres through fifteen wads, in which he found four bacteria. In reducing the results, we find that we have in the air near Niesen between three and four bacteria in a cubic metre.

The richness of the air in this region is easily explained by the locality, the mountain being situated on the border of Lake Thun, and surrounded by a number of towns. Besides this, a small amount of vegetation is found on its summit. It seems that the purity of the air in these high altitudes is due less to the height than to the lack of a productive home for the growth of these organisms. From these experiments it seems perfectly proper to conclude that the mountain air is much purer than that of the lower regions, and even more so than has been supposed. Indeed, it is surpassed in purity only by that over the sea, which Commander Moreau has shown to contain only five or six microbes to ten cubic metres.

RECENT PROGRESS IN ENGINEERING.

SIR FREDERICK BRAMWELL, in his inaugural address as the recently inducted president of the British institution of civil engineers, called attention to the great progress made, during late years, in various departments of engineering. Taking up, first, the materials of construction, he noted the enormous gain in the economy of brick-making by the introduction of brick-making machines and the continuous kiln; the improvement taking place in the making of artificial stones now enabling them to be produced with uniformity of quality, and of such durability as to constitute them successful rivals of natural stones. The use of wood is steadily decreasing, partly in consequence of its scarcity, and of its unfitness for use where longitudinal stresses are to be encountered, and partly through the introduction of the other materials, which are now made at less cost than formerly. Progress is to be expected in the direction of improved processes for the preservation of timber. Asbestos paint, as used on the buildings of the proposed International inventions exhibition, has proved a safeguard in that case against fire.

The modern processes of steel manufacture are furnishing masses of enormous magnitude, and of great uniformity of quality. The processes of Siemens and of Bessemer are now supplying such steels; while the method of Thomas and Gilchrist is permitting the use of ores formerly quite inapplicable to such purposes. The cost of cast-iron is decreasing with the construction of larger furnaces, and the use of more highly heated blast, and with a better understanding of the chemistry of the process of

reduction. Copper is finding new and important applications in the new alloys, phosphor-bronze, manganese-bronze, and other compositions.

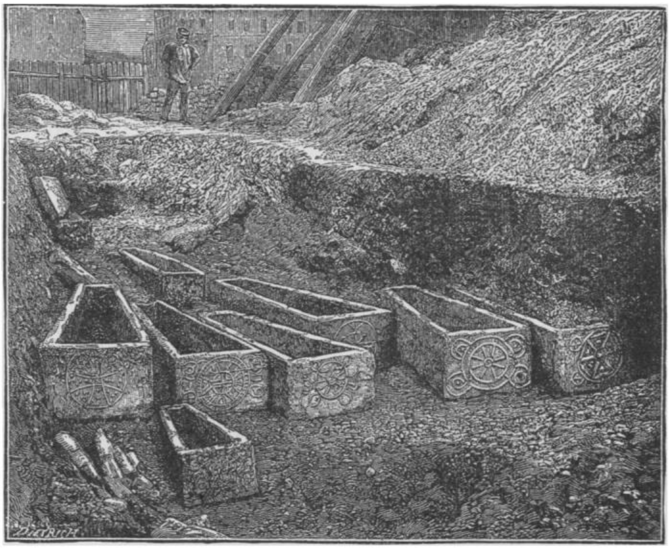
The working of heavy masses is demanding the construction of larger hammers; and it is becoming seen that light steam-hammers are actually injurious to the parts forged by them. Testing-machines are now in daily use, in the hands of the engineer, to determine the exact value of the metals proposed for use in his designs, and to exhibit the strength of completed members.

In bridge-construction, the St. Louis bridge was a novel departure in the use of steel in compression; and the New-York and Brooklyn bridge is an equally successful example of application of wires for suspension over long spans. The new bridge over the Forth exhibits still another modern novelty in its great cantilevers, the only known expedients for successfully spanning seventeen hundred feet with a rigid structure. In railroad and canal construction, the rivalry between the two systems of transportation is best illustrated by the enormous canals, now in progress and proposed, to connect ocean with ocean, and sea with sea, and, as in the case of the Manchester ship-canal, to take ocean-going ships into the interior of the country. This led to the study of harbor-construction, and reference to the methods of making and handling blocks of masonry weighing three hundred and fifty tons each, in the building of their sea-walls. A new and great improvement in the methods of supply of air for respiration, to the workmen sent into the depths during the operations just referred to, is that of absorption of exhaled carbonic acid by a basic salt, and the introduction of oxygen from under compression in small tanks carried by the diver, who is thus enabled to remain under water for considerable periods of time. In tunnelling in red sandstone, a speed of from ten to fourteen yards per day is attained, and of twenty-four yards in chalk. Dynamite and tunnelling machines are making this great progress possible.

Progress in motors has not been rapid during late years. The best of recent double-cylinder non-condensing steam-engines demand but two pounds and seven-tenths of coal per horse-power and per hour; while the condensing-engine has worked down to about a pound and a half. The gas-engine is gradually coming forward as a rival of the steam-engine in small powers; its greater safety, and the reduction of current expenses in various directions, giving it a superiority in some respects. Water-wheels have attained an efficiency of eighty-five per cent; and the turbine, with its high efficiency, offers great advantages in application where the fall is low, or the variation of height of tail-water considerable. In the transmission of power, the introduction of water, steam, and compresed air, sent out from a central station, is a promising direction of progress.

COFFINS OF THE SEVENTH CENTURY.[1]

WHILE digging a trench recently in the rue Salande in Paris, an ancient burial-ground was encountered. The discovery was made among the rubbish and ruined walls of the old Gallo-Roman outskirts at a depth of about one and one-half metres. Nineteen coffins made of plaster, and four or five of stone, were the most interesting things exhumed. The full extent of the burial-ground could not be determined, because it extends beneath some houses. That all



COFFINS OF THE SEVENTH CENTURY.

the sepultures belonged to Christians is probable from the fact that they invariably pointed toward the east, and by the Christian symbols. The coffins belonged to the seventh, eighth, and ninth centuries. Previous to this period they had been made of stone, but those of the epoch under consideration are mostly of plaster. The coffins all had the shape of an elongated trapezoid, being narrower at the foot, and were found filled with dirt, the covers having given way.

The plaster sarcophagi are not unique, since fully two thousand have already been reported as found. Figures are usually imprinted upon the exterior of the head and foot, but not more than one or two in a hundred are ornamented on the long side. The cross emblem of Christianity, inscribed in a circle symbolical of eternity, is the predominant form of ornamentation. There are numerous other ornamentations, but it is difficult to classify them, or to understand their signification.

[1] Abridged from *Science et nature.*

THE MOUNTAINEERS OF TONKIN.

FATHER PINABEL'S "Notes sur quelques peuplades sauvages dépendant du Tong King" is timely. He describes the mountaineers of the valleys of the Maa and Chou rivers, who are called Phou-Tays or Tays, but are commonly known to the Annamites as 'savages.' They reside in villages, are divided into tribes, each having a chief to whom great respect and obedience are accorded. Although, since 1834, Annamite mandarins have been appointed to each tribe, yet the Tays refer all disputes among themselves to their own chiefs, whose authority they recognize as superior to that of the mandarins. Medicine as an art is unknown: each family, however, has some recipe whose preparation is a jealously guarded secret.

The houses are made of bamboo, with roofs covered with palm-leaves; the whole raised upon piles to four feet above the ground. Below is the poultry-yard, where, if the owner is rich, pigs, oxen, and buffalo are kept with the fowl. The square fireplace is made of boards covered with earth. There is no chimney. Upon the hearth are three large stones, arranged as a tripod, on which, if nearly meal-time, rests a pot of boiling water, which supports a bamboo tube containing rice. This tube is pierced so as to permit the steam to pass through the rice, by which it is delicately cooked. The women stay about the cooking-fire, while the men resort to another fireplace at a lower level. If any one wishes to build a house, all the inhabitants of the village come to help, for no other remuneration than the customary feast when the house is finished. To celebrate this event, the head of the family kills a pig or a beef, and offers wine. The wine is made from rice and bran, and left to ferment for about a month in a jar hermetically sealed. When it is opened, water is added, and the guests seat themselves around it, and suck up the liquor through long reeds. The wine, which is sour but agreeable, contains so little alcohol that it is extremely rare to see a person stupidly drunk. After taking the wine, they gather in groups of four about little tables, and eat. This is followed by drinking tea and smoking.

Although amiable and conciliatory, these people are somewhat careless and apathetic, without solicitude for the morrow. Rising with the dawn, they smoke, fritter away some time in the house, start out fasting, and work until ten or twelve, when they return to dine. This repast over, they rest, take a *siesta* in summer, and in the afternoon return to the mountain fields for a few hours, or fish, hunt, or look for bamboos to make palisades about the fields lest the buffalo eat the newly planted rice. The evening is passed quietly in the corner of the hearth, and about eight o'clock supper is served. There are but two meals a day. The women's duties are more arduous than the men's, since, besides those within the house, it is theirs to pick, transport, and store the rice, and to fetch firewood from the mountains.

After death, they bathe the body, clothe it, and envelop it in a coverlid and a mat. Sugar-cane, rice, and salt are put into the mouth, — the sugar-cane to request the *manes* of the dead to be favorable, the salt to beg the deceased to preserve a good heart towards his parents. A rude coffin is made by felling a tree, cutting out of the trunk a piece of sufficient length, which is split and each half hollowed out. The day and hour of placing the body in the coffin are carefully chosen, for fear of evil consequences to the survivors if an unfortunate choice should be made. Before closing the coffin, the body is uncovered, the eyes opened that he may see the heavens, and then the coffin carefully closed. If the means are not at hand to defray the expense of burial, the coffin is preserved in the house, in some cases even for months.

On the day of the final ceremony, if the family is rich, a buffalo is killed, which is offered to the parents and inhabitants of the village, so that they may make charcoal. This charcoal is intended to put into the grave to preserve the coffin from dampness. Another buffalo is killed, so that the assistants may prepare a little hut to be placed over the tomb. A third buffalo is killed for those who inter the body. The site of the tomb is chosen in the forest, where it is forbidden to cut trees, or whatever may grow there, for fear the *manes* of the dead may avenge the outrage. At the end of the ceremony the parents seek the mountain stream. There a diviner has set up two reeds to form a pointed arch, beneath which each parent should pass. They are sprinkled with the water in which the rice was washed, and, after washing their garments, return to the house. At the foot of the ladder, before entering, they tear their hair. The bereaved eat rice from a sort of basket, and leave every thing in the house in disorder to witness to their grief. To the diviner, who reproaches them, they answer, "Our father is dead, and we no more know what to say or do." The diviner then restores the house to order, and sprinkles it with various herbs to chase away evil spirits, that in the future the house may enjoy peace and happiness.

THE WORK OF THE SIGNAL-OFFICE UNDER GENERAL HAZEN.

THE recent examination by the joint commission of General Hazen and other witnesses, as to the efficiency and economy of the present administration of the signal-office, is said to have brought out several statements as to the character of the work done by the weather-bureau, and the progress made by it during the last few years. The following is a brief summary of these, and especially of Professor Abbe's statement showing the status, and work being pursued, during the present fiscal year: —

The signal-service employs one chief, fourteen second lieutenants, and five hundred enlisted men, of whom one hundred and fifty are sergeants, thirty are corporals, and two hundred and twenty are privates, but all generally known as signal-service observers. These five hundred and fifteen persons constitute the signal-corps proper: but six officers detailed from the

line of the army are also temporarily attached to the service; and these have control of the disbursements, the property, the weather-predictions, the display of signals, the testing and comparison of instruments, the arctic stations, the international bulletin, the monthly weather-review, the Pacific coast section, and other main divisions of work.

These six officers, by the operation of the present laws, are being diminished in number by two annually, their places being filled by promotions from among the sergeants of the corps; so that in a few years the service will employ only officers and men of the signal-corps proper. This elimination of officers who have had from ten to twenty years' experience in the signal-service and the army is somewhat deprecated by General Hazen, who is very naturally loath to lose their services, while they themselves are loath to go; although it is evident that the corps proper already contains abundant and excellent material for the future needs of the service.

The signal-service also employs a number of civilians — namely, two chief clerks, several clerks of lower classes, and a scientific staff of three professors, four junior professors, and one bibliographer, and a large number of civilian observers, printers, messengers, artisans, etc. — at various points throughout the country. The number of civilian employees at the central or Washington office is sixty-four, all of whom give their whole time to the work. The total of those employed at other stations is apparently much greater than this; but each is employed only a short time daily, and most of them receive but twenty-five cents per day for some one special observation and record. The enlisted men of the service occupy about two hundred stations scattered throughout the United States, including Alaska, at an average distance of two hundred miles apart. About an equal number of stations are also occupied by civilians, observing the height of water in the rivers, or displaying storm-signals. From about forty-five hundred other civilian observers, reports are received gratuitously by mail on weekly or monthly forms. These observers are classified about as follows: voluntary land-observers, 270; voluntary marine-observers, 480; international observers, 330; Canadian observers, 18; state weather-service, 450; tornado-observers, 1,200; thunder-storm reporters, 2,000.

The following are some of the more prominent and important steps of progress taken during General Hazen's administration: —

The introduction of consulting specialists and civilian experts into the available working-force of the office; the assignment of selected sergeants and privates to work demanding a higher education and special aptness for investigation or study; the organized study of tornadoes, thunder-storms, atmospheric electricity, and other important novel fields of meteorological study; the introduction of weather-signals upon railroad-trains for the benefit of the farmers, and of local town-signals for the benefit of each community; the establishment of more severe rules for the verification of predictions, so that the eighty-five per cent claimed at present means much more than it did a few years ago; the enlistment of a higher grade of men; the improvement of the courses of instruction for men and officers; the compilation of a working-index to the literature of meteorology and the signal-office library; the organization of new divisions in the office, especially of the study-room, the physical laboratory, the marine division, and the examiner's division; the publication of a monthly summary of international simultaneous observation, with a weather-chart showing especially the storms on the Atlantic and Pacific oceans that affect the United States; the special study of atmospheric moisture with a view to improved methods of determining this factor; the special study of the exposure of thermometers, and correct methods for determining the temperature of the air; the maintenance of two polar and several auxiliary stations in pursuance of an international system for the study of the meteorology of the polar regions; the adoption of many of the recommendations of the European international meteorological congresses looking to uniformity of methods throughout the world; the adoption of improved methods of reducing barometric observations to sea-level; the stimulus given to the formation of state weather-services (this great advance has been wholly due to General Hazen, who has not hesitated to declare himself in favor of co-operation, and not monopoly; by his circulars and assistance, over fifteen states have been led to develop minute internal systems for the study of local climate and the dissemination of weather-predictions); the stimulus given to higher scientific work by members of the signal-service, by requiring and publishing professional papers, signal-notes, treatises, etc.; the addition to the signal-office of a few experts in scientific matters, who are responsible for the proper conduct of work requiring special study; the establishment of a high class of standard instruments, and more exact methods for testing-apparatus furnished to the stations, thus assuring against any deterioration in the accuracy of the work through many years to come; the encouragement and co-operation in scientific work, bearing on meteorology, by outside parties, such as spectroscopy, the study of solar heat and atmospheric absorption, and the prosecution of balloon-voyages; the adoption of a uniform standard of time for all observers; the adoption of a uniform standard of gravity for barometric reductions; the introduction of new special cautionary signals for high north-west winds and cold waves; the extension of signal-service stations in Alaska for the proper study of storms that strike the Pacific coast, and are followed by the severe cold waves from Manitoba.

In the prosecution of these and other multifarious labors, the signal-service certainly demands a high degree of organization, discipline, and intelligence; and it is by no means clear that this can be obtained in any better way than by a proper combination of military and civilian observers and scientific men.

THE TENTH VOLUME OF THE CENSUS REPORT.

THE quarto volumes comprising the final report of the tenth census are not only more numerous and larger, and contain more detailed and perfect statistical exhibits of the population and products of the United States, than those of the ninth census, but they are also less purely statistical; the statistics being, in most cases, accompanied by elaborate discussions, which add much to the interest and usefulness of the figures. This statement is applicable to the whole of the tenth volume, but especially to the report on petroleum, by Professor Peckham. The statistics of the production, manufacture, and uses of petroleum, although set forth with all the fulness and detail desirable, are by no means the most prominent feature of this monograph of three hundred solid pages. The literature of petroleum, prior to 1860, was very scanty; but it has kept pace with the phenomenally rapid growth of this industry, being at the present time very voluminous and very fragmentary. Hence it was considered advisable to make this report an authority upon the subject by embodying the results of a careful examination of the entire literature of petroleum, supplemented by the results of the author's own researches before and during the census year. Fortunately, the work was placed in charge of a man well equipped by previous study and investigation; and the outcome is a monograph which the future student of petroleum will not ignore. And a feature not to be overlooked in this connection is the bibliography of petroleum, including more than eight hundred titles chronologically arranged, the earliest dating back to 450 B.C.

Although this work is, in its plan, a comprehensive treatise on the native bitumens of the globe, yet the author has not forgotten that it is in reality a part of the census report; and for this reason, and because of their preponderating importance, it is devoted mainly to the liquid bitumens of the eastern United States. It is conveniently divided into three parts, — the natural history, technology, and uses of petroleum. Part i. is the most important in point of size and general interest, including every thing relating to the mode of occurrence, distribution, origin, and production of petroleum. The geographical distribution of bitumens is illustrated by a series of maps, which show, among other important facts, that east of the Mississippi River the localities affording petroleum — in Canada, Michigan, Indiana, Kentucky, Tennessee, West Virginia, Pennsylvania, and New York — describe an ellipse upon the border of the Cincinnati anticlinal. This correlation of the distribution with the geological structure of the region introduces the very important chapter on the mode of occurrence of bitumens. It is shown here that the statement that bitumens are found in all formations, from the Cambrian to the tertiary, is misleading; since the really productive deposits occur chiefly at two horizons, — the tertiary in Europe, Asia, West Indies, South America, and California; and the Silurian and Devonian in eastern North America. For obvious reasons, the interest centres in the precise geological position of the petroleum in the last-named region; and Professor Peckham, after quoting the views of Hunt, Carll, and Andrews, concludes with the statement that each of these gentlemen is right in his own district; that the petroleum of Canada and West Virginia certainly does, and that of Pennsylvania does not, occur along anticlinal axes.

The scientific student of petroleum will turn eagerly to the chapter on the origin of bitumens, to find each theory explained by copious quotations, and the author's own conclusion, that while the asphalts and oils of California are of animal origin, and indigenous in the strata from which they are obtained, the petroleum of Pennsylvania and West Virginia is clearly of vegetable origin, and a distillate from formations below those in which it is found.

The practical side of the subject next claims attention in the sections on the development of oil territory; the drilling, pumping, blasting, flooding, and general management of wells; and the transportation and commerce of the crude petroleum, with the accompanying statistics. The unpoetical aspect of this industry is very vividly portrayed in the frontispiece and in the following paragraph: —

"The development of the oil territory proceeds without regard to any other interest. The derrick comes like an army of occupation. In the towns a dooryard or a garden alike surrenders its claims. The farms, fields, orchards, or gardens alike are lost to agriculture, and given to oil; and on the forest-covered hills the most beautiful and valuable timber is ruthlessly cut, and left to rot in huge heaps, wherever a road or a derrick demands room. Pipe-lines are run over the hills and through the valleys, through dooryards, along streets, across streets and railroads; and here and there the vast storage-tanks stand, a perpetual menace to every thing near them that will burn. Nothing that I ever beheld reminded

Production, technology, and uses of petroleum and its products, by S. F. PECKHAM. *The manufacture of coke*, by JOSEPH D. WEEKS. *Building-stones of the United States, and statistics of the quarry industry for 1880.* Census report, vol. x. Washington, *Government*, 1884. 26+806 p., 119 pl. 4°.

me so forcibly of the dire destruction of war as the scenes I beheld in and around Bradford at the close of the census year; and nothing else but the necessities of an army commands such a complete sacrifice of every other interest, or leaves such a scene of ruin and desolation."

One important reason for the wonderfully rapid development of oil districts is thus forcibly presented: —

"The owner of oil territory must have it drilled, or it will be exhausted by his neighbors drilling a cordon of wells around his property. After it is drilled, the well must flow until the pressure of gas is exhausted; and after the oil has stopped flowing, if the owner does not pump, his neighbor's pumps will drain his territory; and if he 'pulls out,' the law compels him to fill his well with sand, and ruin it forever, to prevent the public injury resulting from letting surface-water into the oil-sand. There is, therefore, no other alternative presented to the unfortunate possessor of oil territory but to drill and produce, whatever the price of oil may be."

The encyclopedic character of this report is very clearly shown in the second and third parts, in which the statistics of the manufacture and uses of petroleum are preceded by historical and descriptive accounts, either original or compiled, of the apparatus, methods, products, and various applications in the arts; the sections on the use of petroleum for lubricating and illuminating purposes being especially full.

The report on coke is restricted to the coke made as a direct product, and used in blast-furnaces, and does not include that produced in the manufacture of gas. Nor are the coking coals taken into account, except incidentally. This is, like petroleum, essentially a new industry in the United States, the annual value of the coke produced having increased from $189,184 in 1860, to $5,359,489 in 1880; and this is the first time it has appeared prominently in a census report.

The statistics of production for the census year are very full, and are followed by a historical and descriptive account of the industry in the different states and in foreign countries. In the concluding sections, the preparation of the coal, and the various forms of coke-ovens, are described in detail. The statistics show that coke is probably, by weight, the cheapest of all manufactured products, selling for less than two dollars per ton; and that it may be considerably cheapened in the future by the utilization of the waste-products, which greatly exceed in value the coal from which the coke is made.

The census of the building-stones and quarry industry of the United States was planned and organized by the late Dr. George W. Hawes. His untimely death led to a much greater division of labor than is apparent in the preparation of the reports on petroleum and coke, the list of the more prominent contributors to this report comprising nearly a dozen names; and, what is more to be regretted, it also necessitated the curtailment of the strictly scientific portion of the work. The most noticeable feature of this report, from the scientific standpoint, is the absence of any evidence of a serious attempt to improve the really splendid opportunity which the thoroughly representative collection made by the agents of the census bureau presents to investigate the building-stones of this country. The census reports are far from uniform in this respect; some classes of products, such as the woods, cotton, wool, etc., being worked up much more thoroughly.

We do not find in this report any systematic statement of the composition, microscopic structure, texture, specific gravity, crushing strength, porosity, chemical behavior, etc., of our building-stones. In short, the report presents no data forming a basis of comparison by which, to take a practical view of the subject, we can determine the relative merits for particular uses of the products of the fifteen hundred and twenty-five important quarries operated in the United States during the census year. Almost the only distinctly scientific sections of the report are the chapter on the microscopic structure of building-stones, by Mr. Merrill, and that on the durability of building-stones in New-York City and vicinity, by Professor Julien. But the former is short, and on the text-book plan, with but few references to the stones of particular localities. The figures are few and unsatisfactory; the component minerals not being sufficiently distinguished by colors, or otherwise. And, although Professor Julien's essay is excellent so far as it goes, yet it is only a partial and local treatment of the subject.

The student of economic geology will, however, find chapters four to seven, which constitute the main part of the report, very valuable as reservoirs of field-observations, notwithstanding the general lack of experimental or laboratory data. These chapters are devoted to quarry methods, the statistics of production during the census year, descriptions of quarries and quarry regions, and stone-construction in cities. The thirty-two chromolithographic plates which conclude this volume are one of its most attractive features. They show the appearance of polished surfaces of our handsomest marbles, granites, etc.

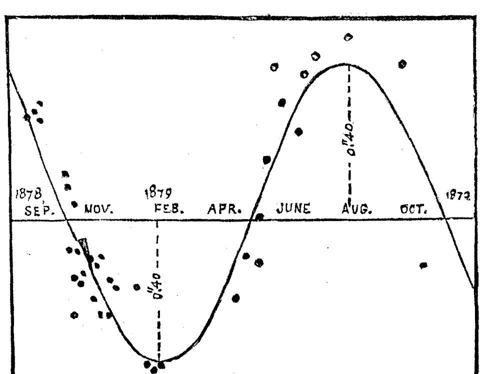
RESEARCHES IN STELLAR PARALLAX.

THE observatory of Trinity college, Dublin, has long been the most famous spot on earth for determinations of stellar parallax; and the labors of the present astronomer royal of Ireland, Dr. Ball, conducted in the same line of research, will make good the claim of this institution to such distinction for a long time to come. Before the time of Dr. Brünnow, formerly astronomer royal at Dunsink, no astronomers had, except in isolated instances, attacked the problem of stellar parallaxes for its own sake; that is to say, the determinations of parallax had come about rather incidentally, and had not been undertaken with the idea of determining stellar distances as the sole end of the research. The painstaking care which Dr. Brünnow exercised as an observer, and his conscientious thoroughness in the subsequent numerical work based on his observational data, were so skilfully combined as to show that the distances of the stars were readily determinable with a hopeful, and to a certain extent satisfactory, precision. The stars with which he was largely occupied were α Lyrae, Groombridge 1830, 85 Pegasi, and δ Draconis.

Dr. Ball, appointed astronomer royal some ten years ago, has wisely devoted the resources of the Trinity college observatory in the main to parallax research, and he has greatly amplified the plans of his predecessor. In the present volume he details the method by which his observations in systematic search for stars with a large parallax have been conducted; and it is plainly apparent how an enthusiastic worker can completely observe so many stars when special pre-arrangements are adopted for the economy of time and labor. With slight changes, these same methods would be equally applicable to the details of other observatory work, and would result in an equal saving: the methods are quite similar to those now so common in the details of library management, and have already been adopted by many astronomers in facilitating their work.

It will be a matter of interest to many to know how, from the myriads of stars in the sky, Dr. Ball was guided in the selection of a list embracing about a thousand objects. In the first place, only such objects were taken as were included between 30° and 65° of north declination, and every object of importance in Admiral Smyth's celebrated cycle of celestial objects was transcribed into the working-lists. Struve's catalogue was also drawn upon, and likewise catalogues of red stars by Schjellerup and Birmingham; the hypothesis with regard to objects of this type being that their color may be due to their small size, and thus presumably less far removed from the solar system. A number of the variable stars, also, are probably very small, and they were included in Dr. Ball's lists for a like reason.

It will not be understood that Dr. Ball's work amounts to a conclusive determination of the distances of all these objects: the objects of his research are at present very different from this; and his labors were directed with main reference to a decision, in all cases, whether the observed stars indicate a sufficiently large parallactic displacement to merit further immediate attention. Of course, there was no disappointment in finding that a very small proportion of the objects examined gave satisfactory evidence of a measurable parallax; but the labors of Dr. Ball are none the less important to future observers as indicating clearly the direction in which there is no pressing need of similar investigation. So much for the inconclusive part of this work. And we may now speak of the positive results in the shape of accurate determinations of the parallax of 61 (B) Cygni, Groombridge 1618, and 6 Cygni (B).



PARALLAX IN DECLINATION OF 61 (B) CYGNI.

The first star belongs to the famous binary system, the first determination of whose distance was made by the illustrious Bessel; and Dr. Ball finds its annual parallax to be very little short of half a second of arc. In order to show the degree of accuracy attained in

Astronomical observations and researches made at Dunsink. Fifth part. Observations in search of stars with an annual parallax. By ROBERT S. BALL, LL.D., F.R.S., astronomer royal.

Heliometer determinations of stellar parallax in the southern hemisphere. By DAVID GILL, LL.D., F.R.S., her Majesty's astronomer at the Cape of Good Hope, and W. L. ELKIN, Ph.D. Forming part i. of the forty-eighth volume of the memoirs of the Royal astronomical society.

such observations, we reproduce Dr. Ball's diagram representing his present series of observations on the assumption of his finally deduced parallax, 0″.4676. If this is the star's true parallax, it cannot affect the observed declinations to a greater extent than 0″.40, which is the maximum length of the ordinates in the curve. The large black dots indicate the observations, while the curve shows at every point the calculated effect of parallax. Of the discrepancies between the two, Dr. Ball remarks, that though some of them "seem large, relatively to the total amount to be measured, yet the greatest divergence of the observation from the curve is not more than the angle subtended by a penny-piece at the distance of fifteen or twenty miles."

Of Groombridge 1618, a star remarkable for its proper motion, we need only say that the parallax resulting from an elaborate series of observations is 0″.322 ± 0″.023; and, of the star (P iii. 242) suggested by Struve as suitable for a parallax series, that Dr. Ball finds its parallax inappreciable. Of the star 6 Cygni (B), however, more should be said, as comparison with 61 (B) Cygni shows both stars to be binary systems, with a large proper motion common to both, and color and magnitude substantially identical. Dr. Ball's investigations point to a parallax of 0″.482 ± 0″.054, so that to the other features of resemblance of the two systems we are to add the fact that the two objects appear to be equally distant from the solar system.

The parallax determinations of Dr. Gill and Dr. Elkin at the Cape of Good Hope are, without doubt, the most thorough and accurate work of the kind ever performed. The heliometer was not a large one, having an aperture of only four inches, and the interval of time set aside for the accomplishment of their programme was but eighteen months. It was considered essential that several of the parallaxes should be investigated independently by both observers, and with different comparison-stars, in order to obtain some test of the general accuracy of the conclusions reached; and, after much consideration and trial, the following stars were finally selected: α Centauri, Sirius, and ϵ Indi, for observation by both Gill and Elkin; Lacaille 9352, o_2 Eridani, and β Centauri, for observation by Gill alone; and ζ Tucanae, e Eridani, and Canopus, for observation by Elkin alone. In *Science*, vol. iii. p. 456, attention has already been called to the results of these investigations, and the remarkable degree of precision attained in the measurements. Every source of error of which it seems possible to conceive was most carefully considered, and terms for the elimination of such errors were suitably introduced into the equations of condition representing all the observations. The observers express their entire confidence, which must be shared by every one who critically examines their work, in the degree of exactitude which is indicated mathematically by their final results. All interested in the progress of stellar astronomy of precision will be glad to know that the important conclusions and suggestions in the memoir, with regard to future extended work in the same fields, are now to be put to the practical test by Dr. Gill and Dr. Elkin conjointly.

DAVID P. TODD.

NOTES AND NEWS.

AMONG the prizes awarded at the annual meeting of the French academy on the 23d of February were the following: the Francoeur prize, to Mr. Emile Barbier; a prize of six thousand francs, for the progress in efficiency of naval forces, was divided between the hydrographic mission to Tunis, and Mr. Baills for a work on artillery ('Traité de balistique rationelle'). Other prizes were given to Messrs. Manen and Hanusse (mechanics); to the Swiss engineer Riggenbach, the Monthyon prize, for his mountain railways; to Mr. Hoüel, the Poncelet prize, for his various contributions to pure mathematics; to Mr. du Rocher du Quengo, for his improvements in screw steam navigation; to Mr. Radau, the Lalande prize, for his memoir on diffractions; Mr. Ginzel, the Valz prize, for a paper on secular acceleration of the moon's motion; to Mr. G. Cabanellas, for his theory of the application of electricity to the transmission of power; Mr. Durand-Claye, for his researches on the diffusion of typhoid-fever; Mr. Chancel, for his work on the acetones; Messrs. Gustave Cotteau and Emile Rivière (geology); Messrs. Otto Lindberg, G. Sicard, L. Motelay, and Vendryès (botany); Mr. P. Fischer (zoölogy); Drs. Testut, Cadet de Gassicourt, and Leloir (medicine and surgery); Mr. Tourneux (embryology); Messrs. Cadiat and Kowalevski in anatomy; Messrs. Jolyet and Laffont in experimental physiology; Capt. H. Berthaut and Jules Girard in physical geography; Mr. Marsaut, 1,500 francs, for his investigations of safety-lamps for miners; Mr. de Tastes, for his work in meteorology; Mr. Valson, the Gegner prize, for his work in mathematics and physics; Dr. Neis, for geographical explorations; Dr. J. Boussingault, for applied chemistry. The Bréant prize of a hundred thousand francs for cholera researches was not awarded.

— The following account of unusual phenomena was received March 10, at the Hydrographic office, Washington, from the branch office in San Francisco. The bark Innerwich, Capt. Waters, has just arrived at Victoria from Yokohama. At midnight

of Feb. 24, in latitude 37° north, longitude 170° 15′ east, the captain was aroused by the mate, and went on deck to find the sky changing to a fiery red. All at once a large mass of fire appeared over the vessel, completely blinding the spectators; and, as it fell into the sea some fifty yards to leeward, it caused a hissing sound, which was heard above the blast, and made the vessel quiver from stem to stern. Hardly had this disappeared, when a lowering mass of white foam was seen rapidly approaching the vessel. The noise from the advancing volume of water is described as deafening. The bark was struck flat aback; but, before there was time to touch a brace, the sails had filled again, and the roaring white sea had passed ahead. To increase the horror of the situation, another 'vast sheet of flame' ran down the mizzen-mast, and 'poured in myriads of sparks' from the rigging. The strange redness of the sky remained for twenty minutes. The master, an old and experienced mariner, declares that the awfulness of the sight was beyond description, and considers that the ship had a narrow escape from destruction.

— A series of experiments has recently been conducted at Spezzia to ascertain the effect of torpedoes on a keel vessel of the type of the iron-clad Italia. Her steel plates were displaced and bent, and the water entered the compartments, but she maintained her position. The result is regarded as showing that the effect of torpedoes is overrated, and that they are insufficient for the defence of forts.

— The U. S. naval bureau of ordnance is experimenting with the megaphone in order to determine its usefulness in detecting the approach of hostile vessels and torpedo-boats while they are yet some distance off. It is thought, also, that by the aid of this instrument it may be possible to communicate between vessels by means of steam or other sound-signals at considerable distances.

— A cablegram received March 10, at the Harvard-college observatory, from Dr. Palisa, announces the probable discovery of Pogson's lost planet. Position, March 9d.3533, Greenwich mean time; right ascension, 6 h. 44 m. 41.7 s.; declination, 28° 10′ 1″. And a message from Dr. Krueger, received March 15, announced the discovery of an asteroid by Dr. Luther. Position, March 14 d. 10 h. 50 m. 52.8 s., Greenwich mean time; right ascension, 11 h. 48 m. 48 s.; declination, + 5° 13′; eleventh magnitude. No motion mentioned.

— The preparations for the Inventions exhibition at South Kensington are proceeding briskly. The literature of the exhibition will differ considerably from that of the two other exhibitions. No handbooks are to be prepared, but the papers which will appear in the catalogue will to a large extent supply their place. The catalogue will contain twenty-three prefaces written by authorities upon the particular subjects intrusted to them. Amongst those who have already consented to contribute are Sir Henry Nugent, on 'Fire-arms and explosives;' Sir E. G. Reed, on 'Naval architecture;' Capt. Douglas Galton, on 'Railway plant;' Capt. Abney, on 'Photography;' Professor Unwin, on 'Machinery;' Professor Armstrong, on 'Physical and chemical apparatus;' Professor Vernon Harcourt, on 'Gas;' Mr. G. Matthey, on 'Fuel;' Dr. Hugo Miller, on 'Paper and printing.' The first part of the catalogue is already in the hands of the printers.

— We learn from *Nature* that the Geological society of London has just awarded the Wollaston medal to Mr. George Busk, for his researches on fossil polyzoa and on pleistocene mammalia; the Murchison medal to Professor Ferdinand Roemer, the eminent paleontologist of Breslau; the Lyell medal to Prof. H. G. Seeley, for his long-continued work on fossil saurians; and the Bigsby medal to Mr. Renard of the Brussels museum, on account of his petrographical researches.

— *Liouville's journal* is in future to be published quarterly to avoid the fragmentary publication of important mathematical papers.

— The original lectures delivered by Harvey at the College of physicians are to be published in autotype from the manuscript in the British museum, accompanied by a transcript.

— The Cambridge (Eng.) university press has just decided to publish Mr. Charles N. Doughty's account of his extensive travels in the interior of Arabia, during which he discovered in the Harras beds of lava similar to those in the Zejah or Argob of the Hauran district, south of Damascus. The maps are already completed: so there will be little delay in the publication.

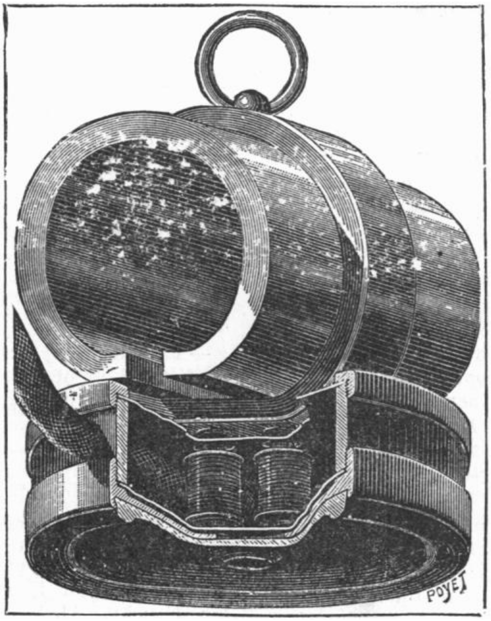
— The *Academy* announces the preparation, by Prof. O. Stolz of Innspruck, of 'Vorlesungen über allgemeine arithmetik,' intended to present in a form suitable to learners the results of modern researches on the science of number. The first part, now in press, contains an introduction on the conception of magnitude, treated in accordance with the views of Grassman; also chapters on the theory of irrational numbers, powers, roots, and logarithms, the theory of functions and of infinite series. The investigations of Hankel, Du Bois-Reymond, Cantor, Cauchy, Abel, Dirichlet, and other eminent mathematicians, have been carefully studied. The second part of the work will treat of the arithmetic of complex numbers, and some of its geometric applications.

— *Mind in nature*, a popular journal of psychical, medical, and scientific information, is announced to be published the first of every month, by the Cosmic publishing company, Chicago.

— The Journal of the Iron and steel institute notices some experiments recently made by Reinau (*Annales industrielles*) to determine the strength of iron as affected by different temperatures. It was found that the strength increased up to 554° F., at which temperature it attained a maximum, being thirty per cent stronger than at 68° F. Between 554° F. and 626° F., the decrease was very little, but the strength rapidly diminished after the last limit was passed. At 806° F. the bar broke under a load of only thirty per cent of the rupture load at 68° F.

— In *Revue de botanique* for October, 1884, Fonssagrives writes that fruits, even after being detached from the tree, give off both poisonous gases and carbonic-acid gas, thereby vitiating the air of a room so as to produce death by poisoning. Such accidents have been caused by ripe apricots, oranges, and quinces, which gave off the gas in the night. Had the air of the room been examined, there is little doubt that a sufficient quantity of oxygen to support life would have been found. Sweet-smelling flowers, such as jasmine, tuberose, and magnolia, and also odoriferous leaves, give off a similar deadly gas; and it seems that this gas must be in some way connected with the odor.

— *La Nature* publishes an account of a new loud-speaking telephone system recently presented by Mr. J. Ochorowicz to the International society of electricians and to the French society of physics. His transmitter is as yet a secret. The receiver, which is figured in the accompanying cut, is the same in principle with that of Bell. The magnet is formed of a hollow steel cylinder, with a slot on one side from five to six millimetres wide. To the centre of this cylinder are attached two little cores of soft iron, on which are rolled the bobbins. These bobbins are enclosed between two disks of thin sheet-iron. The lower plate, which is fixed firmly to the magnet, has two holes which freely allow the passage of the iron cores. The magnetism keeps the box in a state of tension. This receiver, with the peculiar transmitter of Mr. Ochorowicz, allowed speaking, singing, and music to be heard throughout the hall of the Paris geographical society, — a hall accommodating five hundred persons. In the microphone transmitter used by Mr. Ochorowicz, heat seems to play an important part, if one may judge from the fact that all the experiments made before the society of electricians on the 4th of February were successful except the last. Mr. Ochorowicz attributed this to the fact that the microphone needed to be hot: when it ceases to be so, the adjustment is destroyed, and can be re-established only by reheating. Leclanché cells were used, which became polarized, and allowed the transmitter to become cold.



OCHOROWICZ'S LOUD-SPEAKING TELEPHONE.

— A patent has been taken out in France by M. Tichenor for a process of butter-making by electricity. It is stated, that, the milk being placed in a vessel of special form, a pair of electrodes is introduced, and connected to a dynamo capable of yielding a current of forty volts, when in from three to five minutes the butter accumulates at one end of the poles in the form of little balls. The claims include the removal of rancidity from butter, and the manufacture of cheese, by the help of the current.

— We take the following account of the Fritts selenium cells from an advance copy of his paper, to appear in the Proceedings of the American association. "In the first place, I form the selenium in very thin plates, and polarize them, so that the opposite faces have different electrical states or properties. This I do by melting it upon a plate of metal with which it will form a chemical combination, sufficient, at least, to cause the selenium to adhere and make a good electrical connection with it. The other surface of the selenium is not so united or combined, but is left in a free state; and a conductor is subsequently applied over it by simple contact or pressure. During the process of melting and crystallizing, the selenium is compressed between the metal plate upon which it is melted, and another plate of steel or other substance with which it will not combine. . . . The non-adherent plate being removed after the cell has become cool, I then cover that surface with a *transparent conductor of electricity*, which may be a thin film of gold-leaf. Platinum, silver, or other suitable material may also be employed. The whole surface of the selenium is therefore covered with a good electrical conductor, yet is practically bare to the light, which passes through the conductor to the selenium underneath. My standard size of cell has about two by two and a half inches of surface, with a thickness of from $\frac{1}{1000}$ to $\frac{5}{1000}$ of an inch of selenium; but the cells can, of course, be made of any size or form. A great advantage of this arrangement consists in the fact that it enables me to apply the current and the light to the selenium in the same plane or general direction, instead of transversely to each other, as heretofore done."

— *Petermann's mittheilungen* has published a very detailed linguistic map of Hungary, with an article by Dr. T. v. Jekelfalussy of the statistical bureau, from which it appears, that, among every thousand inhabitants of the kingdom, there are 412 Magyars, 125 Germans, 154 Roumanians, 150 Croats and Serbs, and 119 Slovaks.